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EXTENSION BULLETIN

PRESERVATION OF FOOD

Storing, Canning, Drying and Fermentation

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PRESERVATION OF FOOD

In view of the general food shortage and of the shortage of supplies for commercial canning, it is important that fruits and vegetables be preserved by some means. **Food must not be allowed to go to waste.**

Among the reasons for preserving food the following are especially applicable during the present season:

1. To supply fruits and vegetables thruout the year's diet.
2. To provide foods at less cost than the commercially prepared can be obtained.
3. To prevent waste.
4. To insure an adequate food supply for each family thruout the year.
5. To give variety to the diet.
6. To save time in preparation, that the housewife may have more time for her family and war activities.
7. To release the commercially canned goods for use abroad.
8. To increase the world's food supply.

WHY FOODS SPOIL

The spoiling of food is due, principally, to two causes, namely, to the presence of substances called enzymes; to microorganisms, as bacteria, yeasts and molds.

1. **Enzymes.**—These are substances, the exact composition of which is as yet unknown. They are normally present in the cells of fruits and vegetables, and, in fact, in the cells of all plant and animal life. They are known not only for the changes which they bring about, as the ripening of fruits and vegetables, but for the speed with which these changes are effected. It is upon the rapidity of such changes that the method chosen for the preservation of fruits and vegetables depends. For example, apples, potatoes, and parsnips may be stored in cellars or pits, but strawberries, pears, or asparagus must be canned or dried as soon as they are picked. Enzymes are soon destroyed at temperatures above 70° C. and almost instantaneously by boiling water.

2. **Bacteria, Yeasts, and Molds.**—These microorganisms are microscopic plants. They are present everywhere. They feed upon our food and cause it to spoil. Like any other plants, they must have conditions favorable to their life processes, as (1) warmth, (2) moisture, and (3) food. It is desirable and necessary to protect our food from their destructive action, and we may do this (1) by making the conditions unfavorable to their growth, and (2) by killing them. The weapons employed in the first instance are low temperatures, harmless preservatives, removal of water, and cold; in the second instance, high temperature or heat.

Each kind of organism, whether bacteria, yeast, or mold, is adapted to a certain type of food material, and is generally found associated with it. Yeasts may be present in foods containing sugar; molds occur upon many fruits and upon their products, and are instrumental in the spoiling of starchy foods, as bread. Bac-

teria are abundant in most foods, but they grow best on those containing protein substances, as peas, beans, and meat. Some bacteria change into specialized forms fitted to reproduce the species after a period unfavorable to their growth. These resistant forms are called spores. Vegetables are much more difficult to preserve than fruits, as they are ordinarily infected with these spore-bearing bacteria which are capable of withstanding high temperatures. Yeasts and molds, on the other hand, are easily killed by heat.

The whole problem, then, of food preservation, including canning, storing, and drying, involves the destruction of undesirable organisms and the prevention of their growth.

METHODS USED IN THE PRESERVATION OF FOOD

The methods most commonly used in the preservation of food are:

1. By means of low temperature or storage.
2. By means of high temperature or sterilization.
3. By means of drying.
4. By means of harmless preservatives, as sugar, salt, vinegar and spices.

STORAGE

The war gardens of 1918 will greatly increase the production of fruits and vegetables. This means that adequate planning and preparation must be made for the gathering of these products and the safeguarding of them from decay thruout the winter. The supply of cans for the preservation of food the coming season is limited, and for this and other reasons storage and drying must be extensively employed in the saving of the 1918 crop. Not any food must be wasted. Every available can, however, should be utilized, preferably for those fruits which are not easily and satisfactorily preserved by any other method.

Many vegetables can be stored to advantage. Apples, too, can be kept thruout the winter in cellars and pits. Beets, carrots, potatoes, parsnips, sweet potatoes, onions, salsify, celery, cabbage, cauliflower, winter squash, and turnips can be saved for winter use by storage. Good results in storage depend upon:

1. Ventilation
2. Regulation of temperature
3. Sufficient moisture
4. Quality of vegetables.

The bulletin entitled "Fresh Vegetables in Winter," published by the Ohio State University, gives detailed information regarding the storage of vegetables. It may be had for the asking.

CANNING

Success in canning depends upon two things: (1) the sterilization of the food and the can, and (2) the prevention of subsequent contact of microorganisms with the food.

By sterilization is meant the **complete** destruction of all forms of life. The process of canning is practically synonymous with sterilization, which destroys both the vegetative and spore forms of microorganisms. As previously stated, spores are very resistant

to heat. For this reason it is necessary when canning food to make sure that sufficient heat has been applied to kill all forms of life, and that the food is perfectly sealed against a subsequent entrance of these microorganisms.

METHODS OF CANNING

The three methods of canning commonly used in the household are:

1. Open-kettle or hot-pack method.
2. Fractional or intermittent sterilization cold-pack method.
3. One-period sterilization cold-pack method.

In the open-kettle method the food to be canned is cooked in an open kettle, put into a jar and sealed. This method is gradually being displaced by the fractional and the one-period cold-pack methods. The open-kettle method succeeds only with fruits; the other methods succeed equally well with fruits and vegetables, and greatly reduce loss of flavor and loss of food by spoiling.

In the fractional sterilization cold-pack method, as the name indicates, the fruit or vegetable is put into the hot jars cold, covered with hot sirup or water, the jar partially sealed, submerged in boiling water, sterilized from one to two hours on each of 3 successive days, and then sealed. The object in extending the process over a period of 3 days is to allow the organisms in the spore stage to develop into the vegetative form, in which they are more easily killed. This method insures success, but increases the time, labor, and fuel expenditure.

The steps in the one-period sterilization cold-pack method are the same as for the fractional method, with the exception that sterilization is finished at one time or in one period. This method is now generally used thruout the United States for the canning of fruits and vegetables. When directions have been carefully followed it has been attended with success. The advantages of the one-period cold-pack method are:

1. It is quick.
2. It is convenient.
3. Food keeps its flavor, color, and shape.

The time of sterilization given in this bulletin is for the one-period cold-pack sterilization method as used in the hot-water bath outfit or steam-pressure cooker.

EQUIPMENT

Types of Canners.—There are two types of canners: (1) the hot-water bath canner, which can be made in any home with little expense. In this canner sterilization is accomplished by a temperature of boiling water, 212° F. (2) The steam-pressure canner, in which the food is sterilized in live steam under pressure at a temperature above that of boiling water. The time necessary for the sterilization of food in this type of canner is very much less than in the hot-water bath canner. The steam-pressure canner is fitted with a gauge and safety valve, and it carries from 5 to 20 pounds steam pressure. It is expensive. In the steam canners the jars are placed on a tray above a small amount of water that forms the steam in which the products are cooked.

The hot-water bath canner is the type which is most commonly used in the home. It may be made of material found in almost any household, or it may be purchased at a small cost. To make such a canner it requires a can or vessel with a tight-fitting cover and deep enough to allow 2 inches of water to circulate over the top and under the bottom of the jars. A wash boiler, a new lard can, or a new garbage bucket, answers this purpose. A wire or wooden rack is placed inside the vessel to keep the jars off the bottom and also to permit the water to circulate under them. It is a good plan to fasten wire or wooden handles to both sides of the rack with which to lift the crate of cans into and out of the water. Sometimes the lid of the vessel has no handle with which to remove it. If a piece of cheesecloth is spread over the top of the canner before the lid is put on, it can easily be removed by pulling on the ends of the cloth.

CONTAINERS

Use any can or jar that is available, but make sure that it will form a perfect seal before filling it with food. Jars which seal imperfectly are responsible for much of the spoiled fruit and vegetables. Clean the jars and lids thoroly, place them in a vessel of warm water and allow them to come to a boil. Leave them in the boiling water until time to fill them. Much breakage is eliminated if the jar is **hot** when it is submerged in the hot-water bath. Do not attempt to put cold jars in hot water or hot jars in cold water. In most cases they will break.

RUBBERS

Use new rubbers, tho the fact that they are new does not necessarily mean that they are good ones. A good rubber is thick and elastic. Test the elasticity by folding and pulling. If they crack or break they are not good. Wash in boiling water. A good rubber is not spoiled by boiling water. Remember the seal is dependent upon the rubber, and the keeping quality of the sterilized food is dependent upon the seal.

STEPS IN COLD-PACK CANNING

The steps in the canning of fruits and vegetables are practically the same. They are as follows:

1. Collect equipment and utensils, which consist of canner, tables, pails for blanching and cold dipping, cheesecloth or wire basket, sharp knives, measuring cup, colander, forks, spoons, plenty of clean **hot** and **cold** water, and a clock.

2. Select the material to be canned and grade it for quality. A good product can be obtained only where high-grade raw materials are employed and all the operations of canning done quickly and effectively. Put the products into the jars as soon as possible after they are gathered. If vegetables are allowed to remain too long after gathering they are likely to develop "flat sour." They should not be prepared in the evening and allowed to remain overnight.

3. Scald and blanch. This is done by submerging the product in **boiling** water or steam for a definite period of time as given in the canning chart on page 9. This can best be accomplished by putting the product into a wire basket or into a piece of cheesecloth,

and dipping it into the water. The purposes of blanching are:

a. To eliminate any objectionable acids or bitter flavors which may be present.
b. To reduce the bulk in order that a close pack may be obtained.
c. To loosen the skins of tomatoes and peaches.
d. To start the flow of the coloring matter, which is later set by the cold dip.

The canning chart on page 9 indicates the time of blanching and the products to be blanched. Soft fruits are not blanched. All vegetables and some hard fruits are blanched.

4. Cold Dip. Immediately after blanching the product it is dipped into **cold** water. This is known as the cold dip. Time required is from 2 to 5 minutes. This process necessitates changing the water very often in order that it may be **cold.** The reasons for cold dipping are:

"a. To harden the pulp under the skin and thus permit the removal of the skin without injury to the pulp.
b. To coagulate or set the coloring matter in order that the product will keep its color better during the sterilization period.
c. To make the material easier to handle in packing."

5. To remove the skins from beets, carrots, etc.

6. Pack the products closely into a **hot jar.** Some products, as beans, peas, and corn, swell or expand during sterilization. When canning these products, fill the jar to within an inch of the top.

7. Add hot water or sirup. For vegetables use salt and water —1 teaspoon of salt to each quart jar. Pack the jar, add the salt, then hot water. Tomatoes are canned in their own juice; no water is added.

8. Place rubber and cover on the jar. Do not seal tight. If the jar is fitted with a wire bail and clamp, turn down the bail, but leave the clamp up. Inspect the rubber to see that it is flat and that no seeds are under it. If the jar has a screw top, turn the lid down tight with the finger and thumb, then back about a quarter of an inch. If the lids fit too loosely the water or sirup may be drawn out of the jar. If vacuum seal jars are used, put the cover on and the spring in place.

9. Place the jars into the hot-water bath canner containing enough hot water to cover over the tops of the cans to the depth of one or two inches. The jars may be placed in the canner with tongs or a hook, or they may be put on the rack and lowered by its handles.

10. Sterilize according to time table on page 9. Begin to count time when the water strikes a boil. Be sure that the water boils all the time after beginning to count time. Have on hand a kettle of hot water with which to replace any water lost by evaporation from the canner.

11. Remove jars from canner. Do not expose them to cold drafts. Close the windows and doors if necessary.

12. Seal. Examine rubbers to see that they are in place, and finish sealing, that is, screw down covers and fasten clamps. Do

not attempt to turn the top tighter after the jar has cooled. It will break the seal formed by the rubber.

13. Test the seal by inverting the jars. Do not invert vacuum seal jars. If the seal is found to be imperfect, fit the jar with a new rubber or lid as is needed and return to canner for 20 minutes. If the jar cannot be fitted so as to form a perfect seal, empty the contents into a sterilized jar and return to the canner for 20 minutes. Use sterilized fork or spoon in emptying jar.

SIRUPS

Sirups may be made of varying proportions of sugar and water, depending upon the kind of fruit with which they are to be used and the richness of the product desired. Because of the limited supply of sugar it will be necessary the coming season to use thin sirups. A thin sirup is made of 1 cup of sugar and 1 cup of water. Boil for 2 minutes. A very thin or thick sirup is made by decreasing or increasing the amount of sugar, the amount of water remaining constant.

Fruits may be canned without the addition of sugar, and it will probably be necessary to do this the coming season. The flavor, it is true, is better if sugar is added during the cooking process, but in many instances we shall be obliged to make sacrifices.

A thick sirup is used for preserves. This is made of 3 cups of sugar and 1 cup of water; boil until it forms a soft ball when dropped in cold water. Soft fruits are put directly into the thick sirup, but hard fruits, as quince or orange peel, or dried fruits, should be steamed or cooked soft before they are put into the thick sirup, otherwise they become tough. For preserving, use equal weights of sugar and fruit or corn sirup and fruit.

Corn sirup may be used successfully in canning, preserving and jelly-making. For preserves use equal weights of corn sirup and fruit; for canning, one-half cup of corn sirup and ⅓ cup sugar to the pint of canned fruit; for jelly, ¾ cup corn sirup to the cup of fruit juice. When making jelly, evaporate the juice about one-third before adding the sirup, then boil rapidly until the jelly test is secured. This should not take longer than from 5 to 10 minutes. These products made with entire corn sirup are very satisfactory. It may seem desirable to use a small proportion of sugar in them, but it is not necessary. Corn sirup and sugar may be used in varying proportions for canning, preserving and jelly-making.

It is a good plan to extract the fruit juice for jelly and seal it in jars. From time to time it can be made into jelly or used in other ways as desired and as the supply of sugar makes it possible.

CANNING OF MEAT

The most common methods for the preservation of meat in the household are drying and smoking, curing in salt, or cooking and covering with hot fat. Meat may be canned as successfully as vegetables.

Use meat that is in perfect condition. Remove gristle, bone, and excessive fat. Cut in convenient pieces. Sear in a hot oven, in hot fat, or in boiling water for 1 hour. If desired, the bones may be removed from fowls by cooking the meat until tender and remov-

ing meat from them. When the meat has been seared, pack into clean, hot jars, fill with the stock or hot water, add 1 teaspoon of salt to each quart, partially seal and sterilize for 3 hours in hot-water bath canner, or in steam-pressure cooker for 1 hour.

Remove jars, tighten covers, invert to cool and test joints.

CANNING DIFFICULTIES

1. Rubbers popping out from beneath the top during sterilization may be due to poor rubber, to too large a rubber, or to too much pressure from the top. When this happens, remove top and rubber, put on new rubber and the top, and return jar to the canner for 15 to 20 minutes.

2. Jars may break when a cold can is placed in hot water, a hot can in cold water, or when a hot can is placed in a cool draft. When this happens, repack the material in a sterilized can, using sterilized fork or spoon to remove it, put on rubber and sterilized lid, and return to canner for 20 minutes.

3. Liquid is drawn from the can. The tops have been adjusted too loosely. The product will not spoil, tho it is desirable to have it covered with liquid.

4. Vegetables shrink, leaving a space in the can; due to insufficient blanching, or loose packing.

5. Bubbles appear after sterilization; due to imperfect packing of material in the jar. Do not remove them; they do not affect the keeping qualities of the fruit.

6. Cloudy appearance of the liquid in the cans may be due merely to overcooking, which forces out the interior of the product, or to very hard water.

7. "Flat sour" in corn, peas, beans, and asparagus is a condition giving a slightly sour taste and objectionable odor. This is believed to be due to a microorganism which develops rapidly after the vegetable is gathered. **Precaution.**—Free the vegetables thoroly of soil and dust. Put them into the can within three or four hours after picking. Work rapidly. Put rubber and top in place as soon as a jar is filled, and put the jar into the canner at once. It is a bad practice to fill a number of cans before putting the rubber and top in place and the filled cans into the canner.

8. Overcooking is likely to happen with fruits which require a short time for sterilization. Practice will overcome this and other difficulties.

9. Spoiling also results from use of old rubbers, breaking the seal of jars by attempting to tighten the tops after the can has cooled, and imperfect sterilization.

POISONING FROM HOME-CANNED GOODS

There is no cause for alarm concerning the use of home-canned products, providing directions have been followed carefully. Canned goods of any kind should be carefully examined before eating, to ascertain if they are in good condition. If they have a bad taste or flavor they should not be eaten.

All danger of botulism is eliminated if the contents of the can are boiled for a few minutes, since the **Bacillus botulinus** and the toxin or poison which it produces are killed by such treatment.

FRUIT AND VEGETABLE CANNING CHART

Based on Government Home-canning Work

Products to be Canned	Preparations	Sterilize in One-Period Hot Water Bath Outfit 212° F. Minutes	Sterilize under 5-lb. Steam Pressure 228° F. Minutes
Soft Fruits— Strawberries, dewberries, blackberries, blueberries, raspberries, huckleberries.	Grade, rinse, stem, pack whole.	12 to 16	10
Peaches, apricots, sweet cherries, grapes, plums.	Grade, rinse, seed, skin or pit. Pack cherries whole, peaches and apricots pack in halves. Add hot water or sirup.		
Sour Fruits— Currants, gooseberries, cranberries, sour cherries, rhubarb.	Stem, pit, rinse, blanch in hot water 1 minute. Dip quickly into cold water. Pack berries whole, closely. Do not blanch cherries.	12 to 16	10
Hard Fruits— Apples, pears, quinces.	Grade, blanch 1½ minutes in hot water, dip quickly into cold water. Skin, core, pack whole, quartered or sliced. Add sirup. Hard pears and quinces must first be steamed until soft.	20	8
Vegetable Greens— Asparagus, spinach, cauliflower, Brussels sprouts, beet tops, Swiss chard, kale, French endive, dandelion, green or red peppers.	Blanch in steam from 15 to 20 minutes. Dip into cold water. Cut in convenient sizes. Pack tight, season to taste. Add salt and hot water.	120	60
Pumpkin, Squash, Sweet Potatoes—	Remove shell of pumpkin and squash. Steam medium soft. Pack tight. Steam sweet potatoes, remove skin. Pack tight.	120	60
Tomatoes—	Scald long enough to loosen skins. Dip quickly into cold water, core and skin. Pack whole. Add salt.	22	15
Corn—	Blanch on cob from 3 to 5 minutes. Dip quickly into cold water. Cut from cob with sharp knife. Pack loosely. Add salt and hot water.	180	60
Legumes— Peas, Lima beans, string beans, lentils.	Cull, string, grade. Blanch from 2 to 5 minutes in boiling water. Dip quickly into cold water. Pack whole. Add salt and hot water.	180	60
Roots— Beets, carrots.	Cleanse thoroly. Scald till skin is loose. Dip quickly into cold water. Remove skins. Pack whole or in cubes. Add salt and hot water.	90	60

The time of processing or sterilizing is based on quart jars. For half-gallon jars increase the time 10 percent.

The time given is for fresh products at altitudes up to 1,000 feet above sea level. For higher altitudes increase the time 10 percent for each additional 500 feet.

Follow directions carefully if you would prevent failure.

SCORE CARD FOR CANNED FRUIT

Quality	Perfect Score	Score of Exhibit
Color	15	.....
Flavor	60	.....
Condition of fruit	15	.....
Condition of sirup	10	.....
Total	100	.....

SCORE CARD FOR CANNED VEGETABLES

Quality	Perfect Score	Score of Exhibit
Color	15	.....
Flavor	65	.....
Condition of vegetable	20	.....
Total	100	.....

JELLY-MAKING

As long as the nation's supply of sugar warrants it, many fruits may be preserved by the making of jellies, preserves, marmalades, butter, jams, and conserves. Jelly is made from the clear fruit juice and sugar. In preserves the fruit is cooked in a thick sirup and kept as nearly whole as possible. Marmalade, butters and jams are the crushed pulp and juice of fruits cooked with sugar until of a thick consistency. Conserves are mixtures of fruit with nuts or orange peel, prepared much the same as preserves.

Beet sugar and cane sugar may be used interchangeably in jelly-making and the canning of fruit.

"Ideal fruit jelly is a beautifully colored, transparent, palatable product obtained by so treating fruit juice that the resulting mass will quiver, not flow, when removed from its mold; a product with texture so tender that it cuts easily with a spoon, and yet so firm that the angles thus produced retain their shape; a clear product that is neither sirupy, gummy, sticky nor tough; neither is it brittle and yet it will break, and does this with a distinct, beautiful cleavage which leaves sparkling faces.

"Fruit juice consists of water in which are dissolved small amounts of flavoring materials, sugar, vegetable acids, and a substance called **pectin.** Now the vegetable acids * * * take part in the process of jelly-making, but it is this last-named body, pectin, which is the essential jelly-making substance. If pectin be present in a fruit juice it is possible to make jelly from that juice, otherwise it is impossible. Whether or not pectin is present in a juice one can readily ascertain by adding to a given volume of the cold fruit juice (say one or two tablespoonfuls in a glass) an equal volume of grain (ethyl) alcohol (90 to 95 percent), mixing thoroly; * * * if pectin is present a gelatinous mass will appear in the liquid, which may be gathered up on a spoon. The housekeeper, using this test, will discover that, apparently, different juices contain different proportions of pectin; hence, probably, one reason for

the wide difference in various fruits for making jellies. Curiously enough, this pectin frequently is not found in the juices of raw fruits, or, if found, it is likely to be in small quantity. For example, in our experiments we found little pectin in the juice of **raw** apples, **raw** grapes, and none at all in that of **raw** quince, yet the juices extracted from these fruits by **cooking** were full of the substance."[1]

The two substances necessary, then, to make jelly jell are **pectin** and **acid.** Since not all fruits contain pectin only those fruits that do contain it should be used for jelly-making. The fruits that are rich in pectin and suitable for the making of jelly are currants, sour apples, grapes, blackberries, plums, raspberries, and blueberries.

It should be remembered that it requires considerable heat to liberate the pectin from the fruit, which, if large, should be cut in small pieces and cooked slowly until very soft. Failure in jelly-making is often due to failure to cook the fruit long enough. Still other causes for failures are overripe fruit and too large proportion of sugar to juice. Fruit for jelly-making should be underripe rather than overripe.

Proportion of Sugar and Fruit Juice.—The proportion of sugar to be used depends on the amount of pectin present in the fruit juice. A larger proportion of sugar can be used in a juice rich in pectin than in one poor in pectin. In general, the following proportions will be found to give success:

For 1 cup currant juice or underripe grape juice use $\frac{3}{4}$ to 1 cup sugar.

For 1 cup raspberry, blackberry, sour apple, crabapple, plum, or blueberry juice, use $\frac{3}{4}$ cup sugar.

Too much sugar gives a soft jelly which will not stand; too little sugar gives a tough jelly. The boiling of the juice and sugar should be carried on rapidly. The size of the pan determines the amount of juice to be boiled at one time and the time required to finish the product. If it is desirable to boil a large quantity of juice at one time, a large shallow pan must be used in order to hasten evaporation and finish quickly. If such a pan is not available, a less quantity of juice and sugar should be boiled at one time to obtain a good clear product. If too much sugar is added no amount of boiling will correct the failure of the juice to jell. It will remain a sirup. The length of time for the boiling of the juice varies, but usually it is from 5 to 10 minutes. If the juice is poor in pectin it is a better plan to concentrate the juice by boiling for a few minutes before adding the sugar. After the sugar is added to the juice the time of boiling should be reduced to the minimum.

Steps in Jelly-Making.—Select fruits suitable for jelly-making. Wash, and put in an enamel kettle. Crush fruit with a well-soaked wooden masher before or during the cooking. If the fruit is very juicy add a small amount of water—about one-fifth as much as fruit. Cook slowly until very soft. If the fruit is hard it will need

[1] Principles of Jelly-Making. N. E. Goldthwaite, Department of Household Science, The University of Illinois.

to be cooked for at least 1 hour. To such fruits add a large amount of water. As the cooking proceeds add more water if needed. Finally, strain thru a cheesecloth and hang up to drip. Do not squeeze. Measure the juice. Test it for pectin. Use the proportion of sugar to juice which seems suited to it. Put the juice in pan, boil for 1 or 2 minutes, add sugar and finish boiling until the jelly test is given (sheets off as a portion of it is dropped from the spoon). Remove scum as it collects. When jelly test is reached pour hot jelly quickly into sterilized glasses or containers and allow to cool. Pour over it **hot** paraffin in order to kill all germs which may have fallen on the surface of the jelly and to keep others from entering. Cover with tin covers or paper. Keep in clean, dry place. Sometimes it is a good plan to can the extracted juice and make it into jelly as needed.

"Good jellies cannot be made from all juices by 'rule o' thumb.' Jelly-making, as practiced in the home, is an art. It consists in so controlling conditions by means of sugar (and acid) and by boiling, as to cause the pectin to 'set' in a continuous mass thruout the volume allotted to it."[1]

SCORE CARD FOR JELLY

Quality	Perfect Score	Score of Exhibit
Flavor	50	.....
Color	15	.....
Consistency	20	.....
Texture	15	.....
Total	100	.....

DRYING

REASONS FOR DRYING FRUITS AND VEGETABLES

1. Requires fewer and less expensive containers.
2. Requires no sugar.
3. Decreases the bulk—100 pounds raw food products weigh 10 pounds when dried.
4. Less space is required for storage.
5. If carefully packed, dried products can be kept indefinitely.

METHODS OF DRYING

1. Sun.
2. Artificial heat—stove.
3. Air current—electric fan, ventilation.
4. Combination of above methods.

Drying is accomplished by spreading out freshly cut fruits or vegetables so that they may lose their moisture by evaporation as rapidly as possible. It is a simple means of preservation. It requires no expensive apparatus. Practically all fruits and vegetables may be successfully dried in the home.

[1] *Ibid.*

Sun drying requires a bright day and a good brisk breeze. Fruit does not dry so well on a hot, still day as it does on a hot, windy day. When this method is used the products should be spread on trays which are placed in a position to receive the sun's rays and the breeze thruout the day. During damp or rainy days and before sunset the products should be taken indoors.

Precaution should be taken against insects which gain an entrance to the products while drying or after they have been stored. The greatest danger of attack is from moths, which deposit their eggs on the fruit during the sun-drying process. These moths appear early in the evening and at night. The drying products should be screened from them at this time.

When vegetables and fruits are to be dried by artificial heat they should be exposed to a gentle heat at first, and the heat gradually increased to about 145° F. The time of drying varies from 3 hours to 3 days, depending upon the method used and the watchfulness of the person doing the work. When drying in the oven, the door should be left partially open to allow the moisture to escape and to prevent the heat from being too great. Trays or shelves may also be arranged on top of the stove and drying be carried on in this manner.

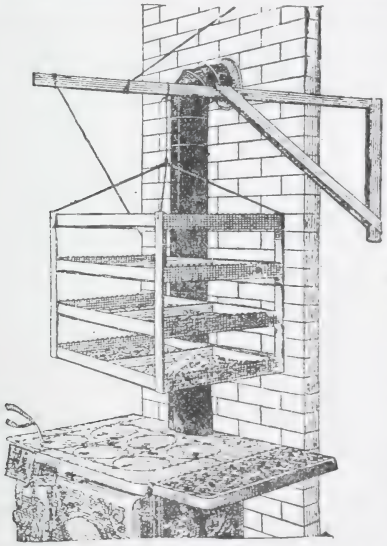

Fig. 1. Homemade drier suspended from swinging crane over cookstove.

The electric fan is a very effective means of drying. A number of trays may be arranged one above the other and placed in front of the fan. Drying is quickly accomplished by this method. When fruit or vegetables are dried quickly they retain a bright color.

It requires a little experience to determine when the products are sufficiently dry. They should not rattle and crack when poured together. One method of testing them is to squeeze them in the hand. If the fruit does not cling together it is dry enough. Dried products should have a leathery and pliable feel when pressed in the hand.

Commercial driers are now on the market. They may be bought at prices ranging from $25 to $100. In some instances these driers have been bought and successfully operated as community driers. When dried products are better known a greater use will no doubt be made of them.

CONDITION BEFORE STORING

Practically all dried vegetables and fruits should be "conditioned" before storing them for the winter. This may be done by placing them in vessels and pouring them from one vessel to the other once or twice a day for 4 or 5 days. If any of the products are found to be too moist they should be returned to the drying trays for a short drying.

EQUIPMENT FOR DRYING

In its simplest form, the equipment for drying consists of trays upon which the products are spread and exposed to the sun. The bottom of the tray may be made of galvanized wire screen, or strips of wood placed ⅛ to ½ inch apart to afford ventilation, and the trays should be supported above the ground to avoid dampness and insects. Barrel hoops across which cheesecloth is tacked are sometimes used as trays. Plan in some way to exclude insects and dust during the drying process.

Fig. 2. Small outdoor drier, easily made at home. It has glass top, sloping for best exposures to sun. The tray is shown partly projecting, to indicate construction. Protect openings around tray with cheesecloth.

SELECTION AND PREPARATION OF FOOD FOR DRYING

Care should be taken in the selection and preparation of fruits and vegetables for drying. Only tender young vegetables and fresh fruits should be used for drying, and they should be prepared and dried very soon after gathering. Neither overripe nor underripe fruits are desirable for this purpose.

Vegetables and fruits are usually cut into slices or shreds. The skin is removed. Berries are dried whole. Knives should be kept bright so that they may not discolor the products.

Sweet corn, green peas, lima beans, string beans, tomatoes, spinach and Brussels sprouts may be conserved by drying. Other vegetables may be added to this list, but it is suggested that storage be used wherever possible. Such fruits as dried apples, peaches, pears, apricots and prunes have long been on the market. These and other fruits, such as berries, may be successfully dried. Do not dry them too hard. If too much moisture is removed from them they do not resume their original shape so satisfactorily when soaked in water.

All vegetables and fruits should be thoroly cleaned before drying. Spinach must be entirely freed of sand and grit, as it cannot be washed out after it is dried. Spinach is an excellent dried product.

Blanching and cold-dipping are desirable for vegetable drying. The reasons given for this are that it gives a more thoro cleansing, removes objectionable odors and flavors, gives better color, and softens and loosens the fiber, allowing quicker and more uniform evaporation of moisture. After blanching and cold-dipping, remove the moisture by shaking in a sieve or colander and placing the vegetables on towels. The time for blanching and cold-dipping of vegetables for drying is approximately the same as for canning. Fruits are not blanched or cold-dipped.

In general, vegetables which are to be dried should be gathered, sorted, washed, blanched, cold-dipped, drained, cut in small pieces, spread thinly on a tray and dried quickly.

String Beans.—Blanch from 5 to 10 minutes and drain; remove stems, tips, and string. If the beans are small they may be left unbroken, strung on a string and hung up to dry, or they may be cut or broken in pieces.

Sweet Corn.—Select young, tender corn. Cook in boiling water from 5 to 8 minutes or until the milk is "set." Cut the kernels from the cob with a sharp knife, taking care not to cut too close to the cob. Scrape out the portion of the kernel remaining. Spread in thin layers on trays and dry.

Tomatoes.—Blanch to remove skin, cold dip, slip the skin, slice to thickness of $\frac{1}{4}$ inch. Spread on trays and dry. A good product.

Spinach.—Wash thoroly to remove sand and grit. Blanch in steam from 10 to 15 minutes, cold dip and drain. Spread on trays and dry. A good product.

Peaches, Plums, and Apricots.—Peaches are usually dried unpeeled. Wash, remove stones, cut in halves, spread on trays to dry.

Berries.—Pick over, wash and drain. Spread in layers on trays and dry.

PREPARATION OF DRIED FRUIT

The aim in the process of drying is to remove water or moisture from the product in order to make the conditions unfavorable to the growth of microorganisms. The aim in the preparation or cooking of dried fruits and vegetables is to replace the water lost by evaporation and to develop flavor. This is best done by soaking in cold water for several hours, usually overnight, and by slow cooking. Wash the dried products, put them to soak in cold water, and cook slowly in the same water until tender. Season during the cooking process or at the end of that time, depending upon the nature of the food and the seasonings added.

Dried products are exceedingly good and are worthy of a trial.

FERMENTATION AND SALTING[1]

Owing to the enormous development of canning in this country during the last generation, and the ease with which fresh vege-

[1] Adapted from Farmers' Bulletin 881—Preservation of Vegetables by Fermentation and Salting. U. S. Department of Agriculture.

tables may be obtained from some part of the country at almost any time of year, relatively little use has been made of these methods of preserving, which were used by our forefathers and which are still used in Europe to a considerable extent. In this country the only substances commonly prepared by fermentation are sauerkraut and salt cucumber pickles, and, as a domestic product in some regions, 'salted beans.' Many other vegetables, however, lend themselves very readily to this method of preservation and furnish products quite different from the original substances, but which are none the less wholesome and appetizing and are greatly liked by many people. They also offer variety in the diet, which is an important consideration.

METHODS DESCRIBED

1. Fermentation with dry salting.
2. Fermentation in brine.
3. Salting without fermentation.

When vegetables are either packed dry with 2 or 3 pounds of salt to every 100 pounds of material, as in the making of sauerkraut, or are covered with a brine containing 5 pounds of salt to every 12 gallons of water, as in the preparation of dill pickles, the sugars present in the vegetables are extracted from them and are fermented by the lactic-acid-forming bacteria which are present naturally in great numbers on the surface of the fresh material. After this action has gone on to a certain point, enough of this lactic acid is formed to kill the bacteria and prevent any further change in the material, provided certain precautions are taken to prevent the growth of molds. The lactic acid has no harmful effect. It is the same acid which is present in sour milk and it is digested and utilized by the body as a source of energy.

If the vegetables are covered with a very strong brine, or are packed with a fairly large amount of salt, lactic-acid formation and also the growth of other forms of bacteria and molds are prevented. This method of preservation is especially applicable to those vegetables which contain so little sugar that sufficient lactic acid cannot be formed by bacterial action to insure preservation of the material.

In the well-known method of vinegar pickling, the acetic acid of the vinegar acts like the lactic acid produced by fermentation as a preservative, preventing the growth of bacteria or molds. Sometimes brining precedes pickling in vinegar, and often the pickling is modified by the addition of sugar and spices, which add flavor as well as help to preserve the fruit or vegetables. In some cases olive oil or some other table oil is added to the vinegar, as in the making of oil cucumber pickles.

EQUIPMENT NEEDED

1. A supply of clean wooden kegs or stone crocks; the smaller sizes are preferred for home use. Cider kegs may be used, but they should be thoroly washed and steamed to remove odor or flavor which might be imparted to the food packed in them. Do

not use vessels made of yellow or pitch pine. Large glass jars may also be used.

2. A supply of ordinary salt purchased in bulk.

3. Clean white cheesecloth for covering the material after it is packed into the container. Cut about 6 inches larger than diameter of vessel so that it will cover all the material.

4. Round pieces of board to put on top of the cheesecloth. Do not use yellow or pitch pine. For small containers, plates may be used.

5. One or more clean stones to serve as a weight to hold down the material in the container.

6. Paraffin is sometimes poured over the liquid in the container after fermentation has ceased, to prevent mold.

7. Scales and measure.

FERMENTATION WITH DRY SALTING

As has already been stated, fermentation with dry salting consists in packing the material with a small amount of salt. No water is added, for the salt extracts the water from the vegetables and forms the brine. The method, in general, is as follows:

Wash the vegetables, drain off the surplus water, and weigh them. For each 100 pounds of the vegetables weigh out 3 pounds of salt; for smaller quantities use the same proportion (3 percent by weight) of salt. Cover the bottom of the keg, crock, or other container with a layer of the vegetables about 1 inch thick, and sprinkle over this a little of the salt. Do not add too much of the salt to the first layers packed, but try to distribute it equally among the different layers so that the quantity which has been weighed out will be sufficient for the given quantity of vegetables packed. If a little of the salt is left over, it can be added to the top layer, but if more has to be added than has been weighed out, the finished product will taste too salty. Continue adding layers of the material sprinkled with salt until the container is about three-fourths full. Sprinkle the last of the salt on the top layer, and spread over it one or two thicknesses of cheesecloth, tucking it down at the sides. On the cloth place one of the round pieces of board or a plate, * * * and on this put a clean stone or one or two clean bricks. The size of the weight depends on the quantity of material being preserved. For a 5-gallon keg a weight of 10 pounds will be sufficient, but if a larger barrel is used, a heavier weight will be needed. The weight added should be sufficient to extract the juices to form a brine, which will cover the top in about 24 hours and sometimes it may be necessary to add more stones after the material has stood a while, if a brine does not form.

After it is packed, allow the container to stand in a moderately warm room to ferment. The salt and pressure of the weight soon extract the water from the vegetables and form a brine which soon covers the whole mass. The stone and board serve to keep the vegetables beneath the surface of the liquid. If the weight is not sufficient for this purpose, a larger stone or more bricks should be added. As the fermentation goes on, bubbles arise to the surface of the liquid. The rate of fermentation depends principally upon the

temperature. In warm weather it requires only from 8 to 10 days; in cool weather from 2 to 4 weeks may be necessary. A good way to determine this is to tap the receptacle gently; if no bubbles arise, fermentation is finished.

The containers should then be placed in a cellar or other cool storeroom and the surface of the liquid treated to prevent the development of a scum of mold. If this is not done a thin film will appear on the surface of the brine soon after fermentation ceases, which will spread rapidly and develop into a heavy folded membrane. This scum is a growth of microorganisms which feed upon the acid formed by fermentation. If allowed to grow undisturbed, all the acid will eventually be destroyed and the fermented material will spoil. This scum must be prevented from forming if the product is to be kept for a considerable time. Exclusion of air from the surface of the brine will entirely prevent its formation. Two methods of accomplishing this are as follows:

1. Cover the surface of the material with very hot melted paraffin to make an air-tight seal. Before adding paraffin, set the container, if large, where it will not be moved until ready for use, as moving it would break the paraffin. The paraffin should not be added until after fermentation. The formation of gas below the layer will break the seal. If the paraffin does break, it should be removed, remelted, and replaced.

2. Fill a barrel or keg as full as possible, cover and weight as described, and let stand for 48 hours to allow part of the gas to escape. Remove the board and weight, and head the barrel or keg up tight. Bore a small hole (about ½ inch) in the head and fill the barrel full with brine (made by dissolving ¾ cup salt in 1 gallon water) so that there is no air space. Allow the barrel to stand until the fermentation has stopped, adding more brine at intervals to keep the container full. When bubbling has stopped, plug the vent tight. If the barrel does not leak, fermented products put up in this manner will keep indefinitely.

Cabbage, string beans, turnips, and beet tops may be conserved in this manner. In general, the method just described should be followed for the preservation of vegetables by the fermentation method.

Sauerkraut.—Sauerkraut may be made from cabbage maturing at any season of the year. The cabbage must be mature, sound, and scrupulously clean. In making sauerkraut, remove the outer leaves and any unsound portion. Shred the cabbage with a hand-shredding machine, slaw cutter, or large knife. Pack **immediately** into container. As it is packed, add salt in the proportion of 1 pound of salt to 40 pounds of cabbage, distributing it evenly thruout the cabbage. Experiments have shown that approximately 2½ pounds of salt to each 100 pounds of shredded cabbage give the best flavor to the resulting kraut. Pack the cabbage by pressing gently with a wooden mallet after the addition of each layer of cabbage. When the container is full, cover with cheesecloth and board, add the weight, and set aside until fermentation is complete. Remove any scum that has formed and cover over with hot paraffin. If the

sauerkraut is made during the fall and stored in a cool place, there is no absolute necessity of a layer of paraffin, since the low temperature will prevent the growth of the organism which destroys lactic acid and causes decomposition. No doubt the popular idea that sauerkraut made from early cabbage will not keep is based upon the fact that the fermentation of sauerkraut made from such cabbage occurs in warm weather and the rapid growth of scum soon destroys both brine and kraut if the surface is not properly protected.

String Beans and Turnips.—These vegetables should be young and tender. Remove tip ends and strings of beans, break or leave whole, pare and slice turnips or cut into long strips and proceed as for sauerkraut. String beans and turnips are sometimes blanched from 3 to 5 minutes before packing.

FERMENTATION IN BRINE

Some vegetables which do not contain sufficient water are better fermented by covering them with a weak brine.

Wash the vegetables, drain, and pack into a vessel until it is nearly full. Cover with a weak brine made of 1 gallon of water, ½ pint of vinegar and ¾ cup salt. Stir until entirely dissolved. The amount of brine necessary to cover the vegetables will be about equal to one-half the volume of the material to be fermented. Set the packed vessel in a moderately warm room to ferment. When fermentation has ceased, put in a cool cellar or room, and treat the surface as in the case of kraut.

Cucumbers, string beans, green tomatoes, corn and green peas may be conserved in this manner.

SALTING WITHOUT FERMENTATION

In this method the vegetables are packed with enough salt to prevent fermentation or the growth of yeasts or molds.

Wash the vegetables, drain off the water, and then weigh them. For each 100 pounds of vegetables weigh out 25 pounds of salt. For smaller quantities use the same proportion of salt (one-fourth of the weight of the vegetables). Spread a layer of the vegetables about 1 inch deep on the bottom of a clean container and sprinkle heavily with some of the salt. Continue until the container is nearly full, then cover as directed for kraut. If the salt and pressure of the weight have not extracted sufficient brine to cover the vegetables, after 24 hours, prepare a strong brine by dissolving 1 pound of salt to 2 quarts of water and pour enough of this over the vegetables to come up to the round wooden cover. When the material is well covered with brine, the surface of the liquid may be treated as for kraut. Cucumbers, string beans, green peas, and corn may be treated by this method.

To prepare for the table, soak cucumbers to remove salt and add spiced vinegar. Remove salt from string beans, peas, and corn by soaking, and prepare in any of the ways in which the fresh product is prepared.

PRESERVATION OF EGGS

At the time of the year when there is an overproduction of eggs, it is desirable to preserve them for use when they are not so abundant. A number of methods have been devised for keeping them, but the most satisfactory method is by the use of water glass. It is simple, efficient and inexpensive.

Eggs that are selected for preserving should be collected daily from clean nests and should in no case be old, sun-baked, cracked or thin-shelled. Infertile eggs are the most desirable.

The container may be any receptacle that is impervious or does not corrode. Glazed earthenware, wooden and galvanized containers are satisfactory. The following gives the sizes of jars, with approximate capacity for eggs and the amount of water-glass solution required to cover the eggs:

1 gallon— 40 eggs, 3½ pints of solution.
2 gallon— 80 eggs, 7¼ pints of solution.
3 gallon—120 eggs, 10¾ pints of solution.
4 gallon—160 eggs, 14½ pints of solution.
5 gallon—200 eggs, 18 pints of solution.
10 gallon—400 eggs, 36 pints of solution.

Water glass as bought on the market is usually in the sirup form and is chemically known as sodium silicate. The best proportion for making the solution is 1 cup of water glass to 12 cups of water that has been boiled and cooled. The eggs need not be put into the solution all at one time, but as they are gathered from day to day. Pack the eggs into the jar with the small end down.

Eggs are sometimes preserved in this way for commercial purposes, but they must be sold as preserved, not fresh eggs. After being in the solution for some time the shell becomes smooth, as the pores are filled with the silicate. When these eggs are boiled the shell should be punctured with a pin at the blunt end, else they will break. In all instances, they should be washed before using.

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